

We claim:

1 1. A fiber optic ring network node connected to a fiber
2 optic ring, comprising:
3 a processor;
4 an interface device coupled to the processor and to the
5 fiber optic ring network; and
6 a storage device for storing computer instructions coupled
7 to the processor, the computer instructions for prompting the
8 processor to generate an overhead signal onto the fiber optic
9 ring by way of the interface device whenever a failure condition
10 occurs in an adjacent communication link within the fiber optic
11 ring network wherein the failure is one that occurs at any one of
12 a plurality of OSI protocol layers.

1 2. The node of claim 1 wherein the computer instructions
2 are formed to detect and cause the processor to generate the
3 overhead signal within fifteen milliseconds of the occurrence of
4 the failure condition.

1 3. The node of claim 1 wherein the failure condition
2 includes an OSI layer 1 communication link failure.

1 4. The node of claim 1 wherein the failure condition
2 includes an OSI layer 2 communication link failure.

1 5. The node of claim 1 wherein the failure condition
2 includes an OSI layer 3 communication link condition.

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1 6. The node of claim 5 wherein the communication link
2 condition includes traffic congestion exceeding a specified
3 threshold.

1 7. The node of claim 1 wherein the fiber optic ring
2 network is a synchronous digital hierarchy (SDH) network.

1 8. The node of claim 1 wherein the fiber optic ring
2 network is a synchronous optical network (SONET).

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1 9. A fiber optic ring network node connected to a fiber
2 optic ring, comprising:
3 a processor;
4 an interface device coupled to the processor and to the
5 fiber optic ring network; and
6 a storage device for storing computer instructions coupled
7 to the processor, the computer instructions for prompting the
8 processor to provide path restoration for data packets affected
9 by a communication link failure on a packet by packet basis
10 within a specified period whenever a communication link failure
11 occurs.

1 10. The node of claim 9 wherein the fiber optic ring
2 network is a synchronous digital hierarchy (SDH) network.

1 11. The node of claim 10 wherein the computer instructions
2 determine a communication link failure has occurred by evaluating
3 an overhead signal that was received from another node on the
4 fiber optic ring network.

1 12. The node of claim 11 wherein the node provides path
2 restoration within a period that is no more than approximately
3 thirty five milliseconds after receiving the overhead signal.

1 13. The node of claim 9 wherein the fiber optic ring
2 network is a synchronous optical network (SONET).

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1 14. The node of claim 13 wherein the computer instructions
2 determine a communication link failure has occurred by evaluating
3 a k1/k2 overhead signal that was received from another node on
4 the fiber optic ring network.

1 15. The node of claim 13 wherein the node provides path
2 restoration within a period that is no more than approximately
3 thirty five milliseconds after receiving the k1/k2 overhead
4 signal.

1 16. The node of claim 13 wherein the specified period is no
2 more than approximately fifty milliseconds.

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1 17. A method in a fiber optic ring network node for
2 forwarding data packets on a packet by packet basis, the packets
3 being received from another node on the fiber optic ring network,
4 comprising:

5 receiving a packet;

6 examining a label value of the received data packet;

7 determining a replacement label having a replacement label
8 value; and

9 forwarding the data packet in one of a plurality of paths in
10 the fiber optic ring network according to the replacement label
11 value.

1 18. The method of claim 17 further comprising the step of
2 replacing a label received in the header of the data packet with
3 the replacement label value.

1 19. The method of claim 18 wherein the replacement label
2 defines a forwarding path route for the data packet.

1 20. The method of claim 19 wherein the node forwards the
2 data packet according to the new path route information found in
3 the new label.

1 21. The method of claim 17 further including the step of
2 determining to output the data packet through a port to an
3 external device rather than to forward the received packet onto
4 the fiber optic ring network.

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1 22. The method of claim 21 further comprising the step of
2 converting the received data packet from a TDM format to an IP
3 format.

1 23. The method of claim 21 further comprising the step of
2 converting a plurality of received data packets from a TDM format
3 to one IP packet having an IP format.

1 24. The method of claim 21 wherein the step of determining
2 to output the data packet to an external device includes the step
3 of examining an output port address specified in the packet
4 header.

1 25. The method of claim 21 wherein the step of determining
2 to output the data packet to an external device includes the step
3 of determining to output the data packet according to an entry in
4 a forwarding table.

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1 26. A method in a fiber optic ring network node for
2 forwarding data packets, comprising:

3 examining all communication links in the fiber optic ring
4 network that are adjacent to the node for OSI layer 1, layer 2
5 and layer 3 types of conditions;

6 determining if a specified failure condition has occurred on
7 any one of the adjacent communication links; and

8 generating an error signal onto the fiber optic ring network
9 to inform all nodes on the fiber optic ring network of the
10 specified failure condition.

1 27. The method of claim 26 wherein the adjacent
2 communication link having the failure condition is down stream on
3 the working path and further wherein the error signal is
4 transmitted onto a protection path.

1 28. The method of claim 26 wherein the adjacent
2 communication link having the failure condition is up stream on
3 the working path and further wherein the error signal is
4 transmitted onto a working path.

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1 29. A method in a fiber optic ring network node for routing
2 data packets serving as an ingress node for IP user traffic,
3 comprising:

4 updating a routing/forwarding table based upon a detected
5 condition in the fiber optic ring network;

6 setting a label in a data packet being transmitted onto the
7 fiber optic ring network, the label having a label value for
8 defining a path route to cause the data packets to be routed on
9 the protection path; and

10 forwarding the data packet.

1 30. The method of claim 29 further comprising the step of
2 receiving a signal in a fiber optic network node identifying a
3 condition in a communication link within the network.

1 31. The method of claim 29 further comprising the step of
2 detecting the condition in an adjacent communication link of
3 fiber optic network.

1 32. A method in a fiber optic ring network node for
2 receiving IP data packets from an external source and for
3 transporting the IP data packets in a converted form through a
4 fiber optic ring network; comprising:

5 receiving the IP data packet;

6 converting the IP data packet to a form suitable for
7 transmitting it on the fiber optic ring network according to a
8 specified protocol, the converted form including a data portion
9 and a header portion;

10 adding a path route indication in a label portion of the
11 header, the path route indication for indicating one of a
12 plurality of possible paths; and

13 forwarding the data packet according to the path route
14 indication.

1 33. The method of claim 32 further comprising the step of
2 reflecting QoS parameters in the header portion of the data
3 packet.

1 34. The method of claim 32 further comprising the step
2 determining whether and when to forward a data packet according
3 to QoS and fiber optic ring network conditions.

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1 35. A TDM signal formed to be transmitted on a packet by
2 packet basis in a fiber optic ring network by a node, the signal
3 comprising:

4 a packet data portion for carrying user traffic data;
5 an address portion for defining a destination address; and
6 a label portion for carrying a label, the label including a
7 label value for specifying a path route for the packet on the
8 fiber optic ring network.

1 36. The signal of claim 35 wherein the label value
2 implicitly identifies a path route on a protection path.

1 37. The signal of claim 35 wherein the label value
2 implicitly identifies the bandwidth of the channel that is to
3 conduct the signal.

1 38. The signal of claim 35 wherein the label value
2 implicitly identifies a QoS rating for the packet.

1 39. The signal of claim 35 wherein the label value
2 implicitly identifies a priority rating for the packet wherein
3 specified signal types from specified signal sources receive an
4 automatic high level of priority in interference situations.

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